SIGGRAPH 2002

SAN ANTONIO

Jigsaw Image Mosaics

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Goal

- Allow tile deformation
- Arbitrarily-shaped container and tiles

Goal

Algorithm Criteria

- Visually pleasing result
- Acceptable computational cost
- Little user effort

Outline

- Motivation
- Related Work
- Framework
- Algorithm
- Results
- Conclusions

Motivation
Fruit Face

Giuseppe Arcimboldo
1527-1593

Summer
1573
Oil on canvas
76x64cm

Louvre Museum
Paris, France

Related works

Mosaicing algorithms

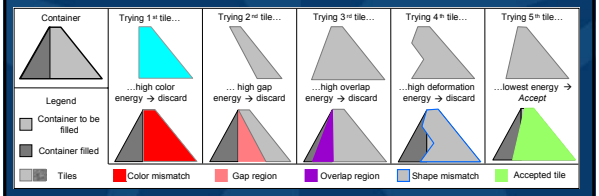
- Photomosaics [Finkelstein, A. and Range]
- Simulated Decorative Mosaics [Hausner]
- Escherization [Kaplan and Salesin]

Packing algorithms [Milenkovic]

Framework

Energy minimization

$$E = w_C \cdot E_C + w_G \cdot E_G + w_O \cdot E_O + w_D \cdot E_D$$

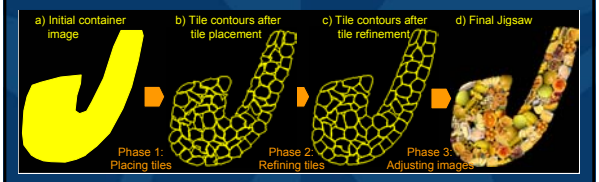


Framework

Energy minimization

- Easy to control
- Easy to extend
- Little user effort

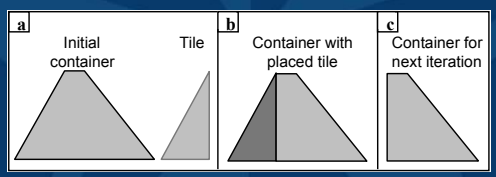
Basic Algorithm Overview



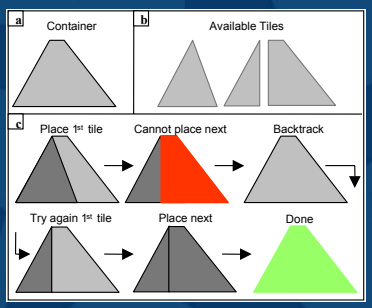
Basic Algorithm Packing

Packing

$$E = w_C \cdot E_C + w_G \cdot E_G + w_O \cdot E_O + w_D \cdot E_D$$



Basic Algorithm Packing



Basic Algorithm Refinement

Packing

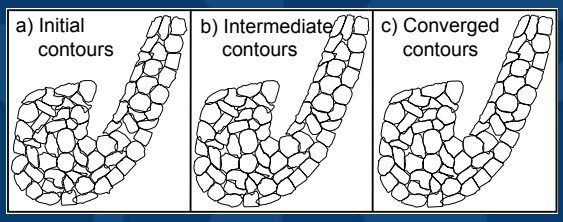
$$E = w_C \cdot E_C + w_G \cdot E_G + w_O \cdot E_O + w_D \cdot E_D$$

Refinement

Active contours [Kass et al. 1987]

- Internal force: Maintain original shape
- External force: Reduce Gap and Overlap

Basic Algorithm Refinement



Basic Algorithm Warping

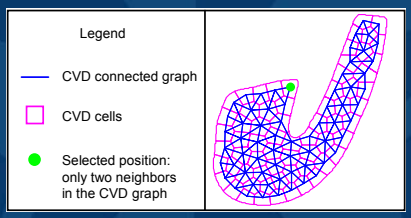
Image warping technique [Arad et al. 1994]

- Radial basis function
- Affine transform

Algorithm Optimization

- Placing a tile
- Branch-bound with Look-ahead
- Geometric hashing

Algorithm Optimization Placing a tile



Algorithm Optimization Look ahead

Packing

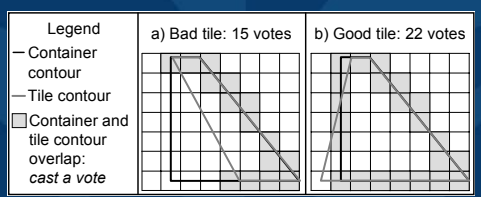
$$E = w_C \cdot E_C + w_G \cdot E_G + w_O \cdot E_O + w_{LA} \cdot E_{LA}$$

Packing w/ Look ahead

$$E_{LA} = w_A \cdot area + (1 - w_A) \cdot length^2$$

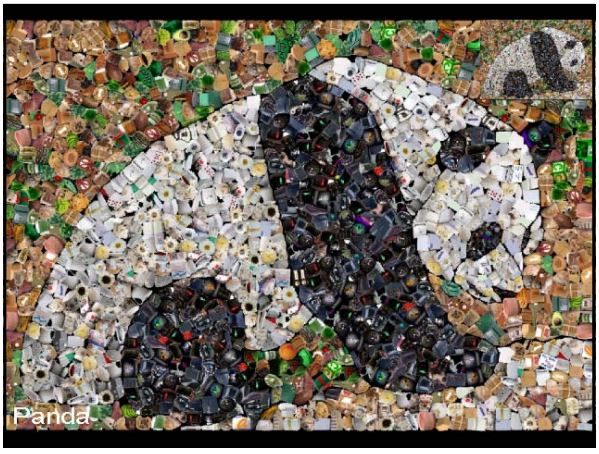
Algorithm Optimization Geometric Hashing

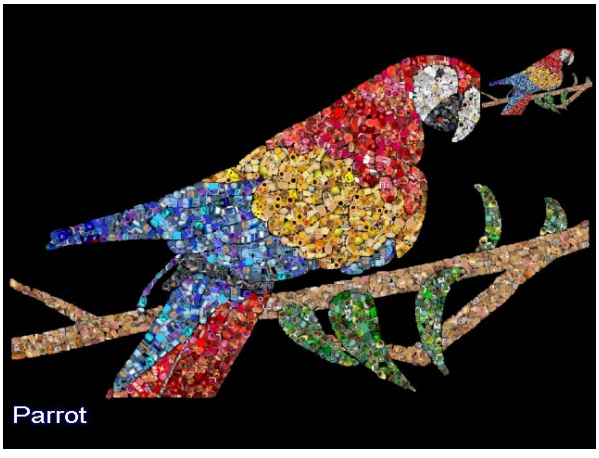
[Wolfson and Rigoutsos, 1997]



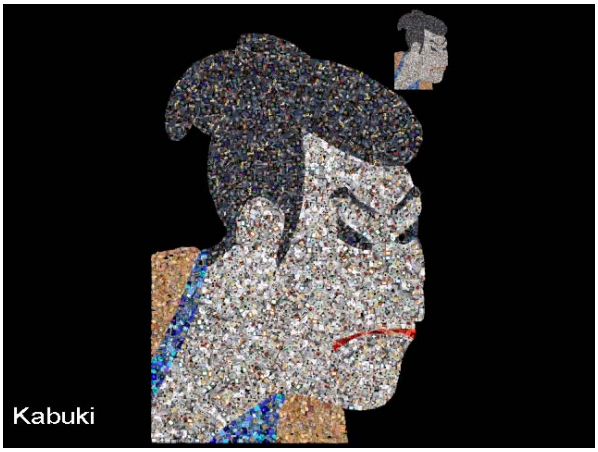
Results

Results





Challenge


Kabuki

Conclusions

Contributions

- New kind of mosaic
- General framework for mosaics
- Effective algorithm

Future work

- Faster algorithm
- Extension to 3D

Acknowledgements

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